DRAFT

UTAH PEDIOCACTUS:

SAN RAFAEL CACTUS
(*PEDIOCACTUS DESPAINII*)

and

WINKLER CACTUS
(*PEDIOCACTUS WINKLERI*)

RECOVERY PLAN

Prepared by

Region 6, U.S. Fish and Wildlife Service

Approved: _____

Date: _____

DISCLAIMER

Recovery plans delineate reasonable actions which are believed to be required to recover and/or protect the species. Plans are prepared by the U.S. Fish and Wildlife Service, sometimes with the assistance of recovery teams, contractors, State agencies, and others. Objectives will only be attained and funds expended contingent upon appropriations, priorities, and other budgetary constraints. Recovery plans do not necessarily represent the views or the official positions or approvals of any individuals or agencies, other than the U.S. Fish and Wildlife Service, involved in the plan formulation. They represent the official position of the U.S. Fish and Wildlife Service only after they have been signed by the Regional Director or Director as approved. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery tasks.

LITERATURE CITATIONS

Literature Citations should read as follows:

U.S. Fish and Wildlife Service. 1995. Utah pediocactus: San Rafael cactus (*Pediocactus despainii*) and Winkler cactus (*Pediocactus winkleri*) recovery plan. Denver, Colorado. 28 pp.

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EXECUTIVE SUMMARY

Current Status: The morphology and habitat of the San Rafael cactus *Pediocactus despainii* and Winkler cactus *P. winkleri* are very similar. While not being sympatric, both species occur on fine textured soils in a desert shrub vegetation type within the Colorado River Drainage of eastern Utah.

Pediocactus despainii is known from three populations with a total number of individuals estimated to be about 20,000. The species is restricted to the San Rafael Swell of central Emery County, Utah. One population is in the northcentral portion of San Rafael Swell north the of San Rafael River. The second is in the southcentral portion of the San Rafael Swell south of Interstate Highway 70. The third is in the western portion of the San Rafael Swell near Interstate Highway 70. Most of the species population occurs on lands managed by the Bureau of Land Management (BLM).

Pediocactus winkleri is known from six populations. The total number of individuals is estimated to be about 5,000. The range of the species forms a narrow arc which extends from the vicinity of Notom in central Wayne County to the vicinity of Last Chance Creek in extreme southwestern Emery County, Utah, with an outlier population near Ferron, Utah, in western Emery County. About half of the species population lies on lands managed by the BLM just east of the Capitol Reef National Park (Park) boundary,with most of the remainder of the population within the Park.

The populations of both species approach each other in western Emery County, Utah, near the southwestern margin of the San Rafael Swell. The species are considered to be closely related and it has been suggested that they may be subspecies of the same species (*P. winkleri*).

Both species are highly desirable specimen plants for cactus collections. The populations of both species have been exploited by both private and commercial collectors for specimen plants for cactus collections. The habitat of both species is vulnerable to surface disturbance from a multitude of uses including off-road vehicle use, trampling by both humans and domestic livestock, and by mineral resource exploration and development. In addition both species have very small populations and limited distributions and as a consequence are vulnerable to adverse stochastic events to their populations.

Goal: Downlisting of *P. despainii* and *P. winkleri* to threatened. These species' small restricted populations and their desirability as specimen plants for cactus collections throughout the world make both species vulnerable to over-collection of their wild populations. As a consequence it is unlikely that these species can be safely removed from the protection of the Endangered Species Act in the foreseeable future.

Recovery and Conservation Criteria:

1. Discover a minimum of five additional separate populations with 2,000 or more individuals per population for each species. These populations must be demonstrated to be at minimum viable population levels.

2. Establish and implement formal land management designations and management plans which would provide for long-term protection on undisturbed habitat for each population of *P. despainii* and *P. winkleri*.

3. Maintain viable populations of both species by ensuring the protection of the current populations and occupied habitat for both species through enforcing the conservation provisions of Sections 7 and 9 of the Endangered Species Act.

Actions Needed:

1. Inventory suitable habitat for *P. despainii* and *P. winkleri* and determine with a high degree of accuracy the population and distribution of each species.

2. Establish and conduct at least five minimum viable population studies, on each of at least five different populations of each species.

3. Determine the biological and ecological factors controlling the species distribution and abundance.

4. Determine phylogenetic relationship of *P. despainii* and *P. winkleri* to each other and to their congeneric species.

5. Document the presence of or, if necessary, establish and implement formal land management designations which would provide for long-term protection on undisturbed habitat for each species.

6. Prevent the collection of *P. despainii* and *P. winkleri* plants from natural populations through Section 9 of the Endangered Species Act and other relevant laws and regulations.

7. Control activities which affect the population of *P. despainii* and *P. winkleri* and their habitat through Section 7 of the Endangered Species Act and other relevant laws and regulations.

Date of Recovery: 2010

Total Cost of Recovery: Unknown

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I. INTRODUCTION

The San Rafael cactus (*Pediocactus despainii* Welsh and Goodrich) was listed as an endangered species under the authority of the Endangered Species Act of 1973, as amended (Act), on September 16, 1987 (52 FR 34917). The Winkler cactus (*Pediocactus winkleri* Heil) was proposed for listing as an endangered species under the authority of the Act on October 6, 1993 (58 FR 52062). The final rule listing the Winkler cactus has been held up in the recent moratorium on listing actions. The U.S. Fish and Wildlife Service (Service) expects to publish the final rule once the moratorium is lifted. For that reason, and because the Service is also preparing multi-species recovery plans and recovery plans that address candidate species where appropriate, the Winkler cactus is included in this recovery plan.

The plant genus *Pediocactus* contains eight species (Heil et al. 1981). Except for one wide-ranging species, all species in the genus are rare endemics of the Colorado Plateau region of Utah, Colorado, New Mexico, and Arizona. In addition to *P. despainii* and *P. winkleri*; the Brady pincushion cactus *P. bradyi*, Knowlton cactus *P. knowltonii*, Peebles Navajo cactus *P. peeblesianus* var. *peeblesianus*, and Siler pincushion cactus *P. sileri* are currently listed as endangered under the Act. These disjunct species are probably relicts of a once, more widespread genus with a distribution that was fractured by climatic change (Benson 1982).

Due to the recent discovery of the San Rafael and Winkler cacti, little information is available on the historic abundance of *P. despainii* and *P. winkleri*. Very little is currently known about the biology and ecology of

both species. Research is needed to determine the species habitat requirements, biological needs and their phylogenetic relationships. Once this information has been acquired, more precise and accurate recovery criteria and needed recovery actions can be developed. The Service fully expects that this recovery plan will be revised in the future to better accommodate biological and ecological needs of these species.

A. Description

Pediocactus despainii was discovered by Kim Despain in 1978 on the San Rafael Swell in Emery County, Utah. Welsh and Goodrich (1980) described the species from Despain's and other specimens collected from the species type locality. *Pediocactus winkleri* was discovered by Agnes Winkler in the early 1960's. The species was described in the scientific literature by Kenneth Heil from specimens collected in the vicinity of Notom, Utah, during 1977 and 1978 (Heil 1979).

Pediocactus despainii is a small, subglobose to ovoid, leafless, stem succulent (cactus). The species usually solitary stems are 3.8 to 6.0 centimeters (cm) (1.5 to 2.5 in) tall, and 3.0 to 9.5 cm (1.2 to 3.7 in) in diameter. The stem apex is even with ground level to 5 cm (2 in) above. Stems are ribbed with tubercles 0.6 to 1.0 cm (0.25 to 0.4 in) long and 0.5 to 1.1 cm (0.2 to 0.45 in) wide. Spine bearing areoles are borne at the apex of the tubercles. The areoles are elliptic with moderate spines partially obscuring the stem. Central spines are lacking, radial spines commonly number 9 to 13. These spines are white, spreading, and 2 to 6 millimeters (mm) (0.08

to 0.24 in) long. Flowers are borne on the upper end of the tubercles near the apex of the stem. The flowers are 1.5 to 2.5 cm (0.6 to 1.0 in) long and 1.8 to 2.5 cm (0.7 to 1.0 in) in diameter. Petaloid perianth parts are oblanceolate, 0.6 to 1.2 cm (0.25 to 0.5 in) long, 4 to 6 mm (0.16 to 0.24 in) wide and have a yellow bronze to peach bronze, or rarely pink a color. The outer perianth parts are yellow bronze, peach bronze, or pink with a purple midstripe. Stamens are yellow and stigmas are green. The fruit is 0.9 to 1.1 cm (0.35 to 0.45 in) long, 1 to 1.2 cm (0.4 to 0.5 in) wide, and top shaped with a smooth surface. The fruit is initially green turning reddish-brown with age and dehiscing with a vertical slit along the ovary wall. Seeds are shiny black and kidney shaped with papillate mounds that coalesce into large irregular ridges. The seeds are 3.5 mm (0.14 in) long and 2.5 mm (o.10 in) wide with a basal hilum 1.5 to 1.75 mm (0.06 to 0.07 in) in length and 1.5 mm wide (0.06 in) (Welsh and Goodrich 1980, Heil et al. 1981, Welsh et al. 1993).

Pediocactus winkleri is a small, subglobose to ovoid cactus. The species stems are solitary or clumped, 3.9 to 6.8 centimeters (1.5 to 2.7 in) tall, and 2.7 to 5.0 cm (1.1 to 2.0 in) in diameter. The stem apex is even with ground level to 5 cm (2 in) above. Stems are ribbed with tubercles 0.4 to 0.7 cm (0.15 to 0.3 in) long and 0.5 to 0.7 cm (0.2 to 0.3 in) wide. Spine bearing areoles are borne at the apex of the tubercles. The areoles are elliptic and densely wooly pubescent with spines obscuring or partially obscuring the stem. Central spines are lacking, radial spines commonly number 9 to 11. The spines are white tan, spreading downward, with tips tapering from bulbous bases and 1.5 to 4 mm (0.06 to 0.16 in) long. Flowers are borne on the upper end of the tubercles near the apex of the stem. The flowers are 1.7 to 2.2 cm (0.7

to 0.9 in) long and 1.7 to 3.0 cm (0.7 to 1.2 in) in diameter. Petaloid perianth parts are oblanceolate, 1.0 to 1.5 cm (0.4 to 0.6 in) long, 4 to 6 mm (0.16 to 0.24 in) wide and have a peach to pink color. The outer perianth parts are peach to pink with a reddish-brown midstripe. Stamens are yellow and stigmas are green. The fruit is 0.7 to 1.0 cm (0.3 to 0.4 in) long, 0.8 to 1.1 cm (0.3 to 0.45 in) wide, and top shaped with a smooth surface. The fruit is initially green turning reddish-brown with age and dehiscing with a vertical slit along the ovary wall. Seeds are shiny black and kidney shaped with papillate mounds that coalesce into large irregular ridges. The seeds are 3.0 mm (0.12 in) long and 2.0 mm (0.08 in) wide (Heil 1979, Heil et al. 1981, Welsh et al. 1993).

B. Habitat and Distribution

Pediocactus despainii grows in fine textured, mildly alkaline soils rich in calcium derived from limestone substrates of the Carmel Formation and the Sinbad member of the Moenkopi formation (Heil 1984a, Kass 1990). The species also has a population growing on shale barrens of the Brushy Basin member of the Morrison formation (Kass 1990). The species most commonly occurs on benches, hill tops and gentle slopes, most abundantly on sites with a south exposure. *Pediocactus despainii* populations are a component of the vegetative community occurring at the lower elevations of a pinyon-juniper woodland plant community and the upper elevations of a galleta-three awn shrubsteppe community of the Canyonlands section of the Colorado Plateau Floristic Division (Cronquist et al. 1972, Kuchler 1964). The vegetative community is characterized by an open woodland of scattered Utah juniper

(*Juniperus osteosperma*) and pinyon pine (*Pinus edulis*) with an understory and open parks of shrubs and grasses characterized by *Ephedra torreyana*, *E. viridis*, *Leptodactylon pungens*, *Gutierrezia sarothrae*, *Atriplex confertifolia*, *A. canescens*, *Tetradymia nuttallii*, *Haplopappus linearifolius*, *Ceratoides lanata*, *Sclerocactus parviflorus*, *Opuntia polyacantha*, *Yucca harrimaniae*, *Sporobolus airoides*, *S. cryptandrus*, *Stipa hymenoides*, *Aristida longiseta*, *Hilaria jamesii*, *Bouteloua gracilis*, *Aster* spp., *Astragalus* spp., and *Cryptantha* spp. (Heil 1984a).

Pediocactus despainii is known from three populations with a total number of individuals estimated to be about 20,000. The species is restricted to the San Rafael Swell of central Emery County, Utah (Figure 1). One population is in the northcentral portion of San Rafael Swell north of the San Rafael River. The second is in the southcentral portion of the San Rafael Swell south of Interstate Highway 70. The third is in the western portion of the San Rafael Swell near Interstate Highway 70. Most of the species population occurs on lands managed by the Bureau of Land Management.

Pediocactus winkleri grows in fine textured, mildly alkaline soils derived from siltstone and shale substrates of the Dakota Formation and Brushy Basin member of the Morrison Formation (Heil 1984b, Neese 1987). The species most commonly occurs on benches, hill tops and gentle slopes, most abundantly on sites with a south exposure. *Pediocactus winkleri* populations are a component of the saltbrush vegetative community of the Canyonlands section of the Colorado Plateau Floristic Division (Cronquist et al. 1972, Kuchler 1964). The vegetative community is characterized by drought tolerant shrubs and

In preparation

Figure 1. Range of Pediocactus despainii and Pediocactus winkleri.

grasses with ephemeral forbs. Cacti are a conspicuous component of this vegetative type. The following species are components of this plant community: *Atriplex confertifolia, A. corrugata, Ephedra torreyana, Gutierrezia sarothrae, Tetradymia nuttallii, Chrysothamnus pulchellus, Sclerocactus wrightiae, Echinocereus triglochidiatus, Opuntia polyacantha, Yucca harrimaniae, Stipa hymenoides, Aristida longiseta, Hilaria jamesii, Bouteloua gracilis, Erioneuron pulchellum, Aster* spp., *Astragalus* spp., and *Cryptantha* spp. (Heil 1984b). *Pediocactus winkleri* has populations growing sympatrically with the listed endangered species *Sclerocactus wrightiae* (Heil 1984b, Neese 1987, U.S. Fish and Wildlife Service 1985, 1994)

Pediocactus winkleri is known from six populations. The total number of individuals is estimated to be about 5,000. The range of the species forms a narrow arc which extends from the vicinity of Notom in central Wayne County to the vicinity of Last Chance Creek in extreme southwestern Emery County, Utah, with an outlier population near Ferron, Utah, in western Emery County (Figure 1). About half of the species population lies on lands managed by the Bureau of Land Management just east of the Capitol Reef National Park (Park) boundary with most of the remainder within the Park.

The populations of both species approach each other in western Emery County, Utah, near the southwestern margin of the San Rafael Swell. *Pediocactus despainii* and *P. winkleri* are currently treated, in all taxonomic treatments involving those species in regional floras (Welsh et al. 1993) and monographic treatments of the genus (Heil et. al 1981; Kenneth Heil, San Juan Community College, Farmington New Mexico, pers. comm. 1994), as separate species. The

two species, however are phylogenetically close, and it has been suggested (Kass 1990) that the two species may be best treated taxonomically as varieties of *P. winkleri*, the first of the two species to be described in the scientific literature (Heil 1979, Welsh & Goodrich 1980). The two species are, however, morphologically distinct and geographically separated. Attempts to cross-breed the two species in controlled horticultural situations have been unsuccessful, suggesting that the current taxonomic classification of these species is accurate (Kenneth Heil, pers. comm. 1993).

C. Population Biology

Flowering of *P. despainii* and *P. winkleri* occurs from April to May and fruiting occurs May to June in both species. The specific time varies from year to year apparently due to temperature and moisture conditions of late winter and early spring. The lower elevation populations of *P. winkleri* usually flower 5 to 15 days earlier than *P. despainii*. Reproduction in both species is sexual. The factors which govern the distribution of *P. despainii* and *P. winkleri* are not well known, nor are the long-term population dynamics. The effect of natural factors, such as disease, parasitism, grazing by native species, natural erosion, and vegetative competition on the viability of the species population is not known. The specific pollination mechanism and vectors for *P. despainii* and *P. winkleri* are believed to be wild bees of the Halictidae family.

D. Threats

Pediocactus despainii and *P. winkleri* face similar threats. Both species are attractive small cactus, especially when in flower. Although difficult to cultivate in most horticultural settings, these rare species are highly desired in cactus collections and gardens and have been sought by both hobby and commercial cactus collectors (Hochstätter 1990; Steven Brack, Mesa Gardens, Belen, New Mexico, pers. comm. 1994; Kenneth Heil, pers. comm. 1993). Cactus collectors are very active in the Colorado Plateau, often going from the habitat of one species of *Pediocactus* to the next to collect a complete set (Kenneth Heil, pers. comm. 1994; U.S. Fish and Wildlife Service 1994). Except for the Endangered Species Act, no Federal or State laws or regulations directly protect *P. despainii* or *P. winkleri* or there habitat. The National Park Service restricts, and in most cases forbids, the collection of plants and plant materials form National Parks including Capitol Reef. The Bureau of Land Management has the authority to control the removal of vegetative materials from Federal lands under their management. The populations of both species are scattered over desolate country, and this makes monitoring the species to protect them from unauthorized collecting difficult, even in the Park.

The small, restricted populations of *P. despainii* and *P. winkleri* make them highly vulnerable to human-caused habitat disturbances. Although the exact size of the historical range of these species is unknown, their known habitat has been adversely affected by off-road vehicle use and livestock trampling (Heil 1984a, 1984b, 1987; Kenneth Heil, per. comm. 1993; Neese 1987; U.S. Fish

and Wildlife Service 1994). These species have some natural protection from light trampling from humans and soft wheeled vehicles by their habit of shrinking into the ground for portions of each year. However, these species form flower buds in the autumn that over winter (Heil et al. 1981). These flowering buds at the ground surface level are very vulnerable to surface disturbance, increasing the portion of the year that the species' flowers and hence their reproductive capacity is lost or diminished.

Because of their small size and the shortness of their spines *P. despainii* and *P. winkleri* are less protected from animals than other spinier cactus species. During periods when the soil is wet, these species are easily dislodged by sharp-hoofed domestic livestock. Livestock trampling has affected populations of both *P. despainii* and *P. winkleri* both in and out of Capitol Reef National Park (Capitol Reef National Park is not closed to livestock grazing) (Heil 1987; Kenneth Heil, pers. comm. 1993). Livestock grazing on the species habitat, however, has decreased significantly in recent years, but trampling impacts to some of these species populations continues (Kenneth Heil, pers. comm. 1993; U.S. Fish and Wildlife Service 1994). The full effect of livestock grazing on *P. despainii* and *P. winkleri* is unknown. The effects of livestock grazing on desert vegetation may produce indirect impacts on *P. despainii* and *P. winkleri* populations. These species are susceptible to infestations of beetle larvae (U.S. Fish and Wildlife Service 1994).

The habitat of *P. despainii* is underlain by potential oil and gas reserves and gypsum deposits. The habitat of *P. winkleri* is underlain by bentonite clay and some uranium ore deposits. The development of these deposits and surface

disturbance by annual assessment work on mineral claims for gypsum, uranium, bentonite clay, petroleum, and possibly other minerals has the potential for adversely impacting these species and their habitat.

The very low population size and restricted habitat of both *P. despainii* and *P. winkleri* render the species vulnerable to human disturbances of their habitat. These disturbances can exacerbate natural disturbances to the species populations. It is not known if the species populations are at levels which would ensure their continued existence. The species numbers are sufficiently small that future losses may result in the loss of genetic viability.

II RECOVERY

A. Objective and Criteria

The primary objective of this recovery plan is to maintain viable populations of *Pediocactus despainii* and *Pediocactus winkleri*. A secondary long-term objective is to initiate conservation and recovery measures which may lead to the downlisting of *P. despainii* and *P. winkleri* to threatened. These species' small restricted populations and their desirability as specimen plants for cactus collections throughout the world make both species vulnerable to over-collection of their wild populations. As a consequence it is unlikely that these species can be safely removed from the protection of the Endangered Species Act in the foreseeable future.

If the inherent vulnerability of the species is decreased to the point that localized threats will not jeopardize the species, the downlisting of *P. winkleri* and *P. despainii* may be possible. These reclassification activities can be considered when the conservation of these species populations within their natural habitat is sufficient to ensure their continued existence as a viable self-sustaining population throughout their known ranges.

Reclassification under the Act may occur if 1) the species abundance and distribution is increased by identification of additional stands and 2) minimum viable population studies and other biological information indicates that the species numbers and distribution is sufficient to maintain long-term

species viability. Under these conditions, downlisting is anticipated to be possible when the following Recovery and Conservation Criteria are met:

1. Discover a minimum of five additional separate populations with 2,000 or more individuals per population for each species. These populations must be demonstrated to be at minimum viable population levels.

2. Establish and implement formal land management designations and management plans which would provide for long-term protection on undisturbed habitat for each population of *P. despainii* and *P. winkleri*.

3. Maintain viable populations of both species by ensuring the protection of the current populations and occupied habitat for both species through enforcing the conservation provisions of Sections 7 and 9 of the Endangered Species Act.

Actions Needed:

1. Inventory suitable habitat for *P. despainii* and *P. winkleri* and determine with a high degree of accuracy the population and distribution of each species.

2. Establish and conduct at least five minimum viable population studies, on each of at least five different populations of each species.

3. Determine the biological and ecological factors controlling the species distribution and abundance.

4. Determine phylogenetic relationship of *P. despainii* and *P. winkleri* to each other and to their congeneric species.

5. Document the presence of, or if necessary, establish and implement formal land management designations which would provide for long-term protection on undisturbed habitat for each species.

6. Prevent the collection of *P. despainii* and *P. winkleri* plants from natural populations through Section 9 of the Endangered Species Act and other relevant laws and regulations.

7. Control activities which affect the population of *P. despainii* and *P. winkleri* and their habitat through Section 7 of the Endangered Species Act and other relevant laws and regulations.

The above objectives and criteria are preliminary and subject to change as more information becomes available. The estimated date for accomplishing the short-term goal of down-listing both species is the year 2005. The total cost for recovery is unknown.

B. Stepdown Outline for Recovery Tasks Addressing Threats

1. **Prevent collecting and destruction of *P. despainii* and *P. winkleri* plants from wild populations.**

   1.1 Enforce Federal laws and regulations controlling the unauthorized removal and destruction of plants from Federal lands.

   1.2 Protect *P. despainii* and *P. winkleri* from international trade and commercial exploitation.

   1.3 Prevent intra-State trade, collecting, and damage of *P. despainii* and *P. winkleri* on areas not under Federal jurisdiction.

   1.4 Promote commercial propagation of *P. despainii* and *P. winkleri* in gardens and greenhouses to meet the market demand for these species.

2. **Control activities which affect the habitat of *P. despainii* and *P. winkleri* through Section 7 of the Endangered Species Act and other relevant laws and regulations.**

   2.1 Control mineral development activities within the habitat of *P. despainii* and *P. winkleri*.

   2.2 Control other activities which may affect *P. despainii* and *P. winkleri*.

3. **Inventory suitable habitat for each species and determine their population and distribution.**

   3.1 Inventory suitable habitat for *P. despainii*.

   3.2 Inventory suitable habitat for *P. winkleri*.

4. **Establish and conduct monitoring, biological, ecological, life history and minimum viable population study for each species.**

   4.1 Establish and conduct monitoring, life history and minimum viable population study for *P. despainii*.

   4.2 Establish and conduct monitoring, life history and minimum viable population study for *P. winkleri*.

   4.3 Evaluate the phylogenetic relationships between *P. despainii* and *P. winkleri*,

5. **Establish and implement formal land management designations which would provide for habitat protection for *P. despainii* and *P. winkleri*.**

   5.1 Land management designations for *P. despainii*.

   5.2 Land management designations for *P. winkleri*.

6. **Propagate individuals of *P. despainii* and *P. winkleri* in horticultural facilities.**

7. **Develop public awareness, appreciation and support for the conservation of *P. despainii* and *P. winkleri*.**

C. Narrative for Recovery Tasks Addressing Threats

1. Prevent collecting and destruction of *P. despainii* and *P. winkleri* plants from wild populations. Section 9 of the Act makes it unlawful to remove and reduce to possession, maliciously damage, or destroy any listed endangered plant species from areas under Federal jurisdiction or to remove, cut, dig up, damage, or destroy any such species in knowing violation of any law or regulation of any State or in the course of any violation of a State criminal trespass law. The Service and other Federal agencies are responsible for ensuring that populations of both *P. despainii* and *P. winkleri* on lands under Federal jurisdiction are not affected by unauthorized collection. Control of this threat will be accomplished with periodic monitoring of the species' populations by Fish and Wildlife Service, Bureau of Land Management, and National Park Service and local law enforcement agents and taking appropriate action when necessary.

1.1 Enforce Federal laws and regulations controlling the unauthorized removal and destruction of plants from Federal lands. Section 9 of the Act explicitly forbids the destruction or removal of listed

endangered plant species from areas under Federal jurisdiction and from all other lands, if the act of theft or vandalism was committed in knowing violation of State statutes, including trespass laws. The large majority of the total population of both *P. despainii* and *P. winkleri* is on Federal land under the management of the Bureau of Land Management and the National Park Service. These agencies will use their law enforcement authority resources to ensure that both *P. despainii* and *P. winkleri* populations are not subject to damage and unauthorized collection.

1.2 Protect *P. despainii* and *P. winkleri* from international trade and commercial exploitation. *Pediocactus despainii* and *P. winkleri* are both listed in Appendix I of The Convention of International Trade in Endangered Species of Wild Fauna and Flora (CITES). CITES import and export permits are required for international trade in Appendix I species, and permits generally are not allowed for primarily commercial shipments. By maintaining both species on Appendix I of CITES, it will make illegal the international export of plants of these species, unless the proper permits are obtained from the Fish and Wildlife Service. No CITES permits should be issued for plants collected in the wild. The Service's Office of Management Authority and Law Enforcement Division will monitor trade of cactus species to ensure that this species is not illegally traded.

1.3 Prevent intra-State trade, collecting, and damage of *P. despainii* and *P. winkleri* on areas not under Federal jurisdiction. The Service

will encourage the State of Utah to enforce existing State statutes and regulations which pertain to the regulation and control of the sale of vegetative materials and destruction of vegetation by off-road vehicles.

1.4 Promote commercial propagation of *P. despainii* and P. winkleri in gardens and greenhouses to meet the market demand for this species. The Service will work with legitimate cactus horticulturists to provide a source of *P. despainii* and *P. winkleri* plants to satisfy the horticultural demand for this species. This will be accomplished by using plants currently in cultivation and, if necessary, with seed collected from wild populations under permit.

2. Control activities which affect the habitat of *P. despainii* and *P. winkleri* and through Section 7 of the Endangered Species Act and other relevant laws and regulations. The majority of the known habitat of *P. despainii* and *P. winkleri* occurs on Federally managed lands. Section 7(a) of the Act requires Federal agencies to evaluate their actions with respect to any species that is proposed or listed as endangered or threatened. Regulations implementing this interagency cooperation provision of the Act are codified at 50 CFR Part 402. Section 7(a)(1) requires all Federal agencies to carry out programs for the conservation of endangered and threatened species. Section 7(a)(2) requires Federal agencies to insure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of such a species or to destroy or adversely modify its critical habitat. If a Federal action may

adversely affect a listed species or its critical habitat, the responsible Federal agency must enter into formal consultation with the Fish and Wildlife Service (Service). Activities undertaken, permitted, or funded by the Bureau of Land Management (BLM) and National Park Service (NPS) have the potential to affect *P. despainii* and *P. winkleri*. These agencies are required to consult with the Service whenever their proposed activities may affect this species or its habitat.

2.1 Control mineral development activities within the habitat of *P. despainii* and *P. winkleri*. *Pediocactus despainii* and *P. winkleri* were listed as endangered species in part because of the potential of mineral development actions adversely impacting these species. The BLM will be the agency primarily responsible to ensure that mineral development activities do not adversely affect these species. Virtually the entire habitat of *P. despainii* and *P. winkleri* occurs on federally managed public land under the jurisdiction of the BLM and NPS. Mineral and energy development activities on Federal land will require the necessary lease permits, etc., from the BLM before they can proceed.

2.2 Control other activities which may affect *P. despainii* and *P. winkleri*. The monitoring of *P. despainii* and *P. winkleri* populations will enable the identification of other activities affecting the species populations. When and if such other activities are identified they will be evaluated and actions implemented to prevent adverse impact to the species population.

3. Inventory suitable habitat for each species and determine their population and distribution. An inventory of all suitable habitat is needed to identify essential habitat and to verify those stands for which protection is required to best ensure the long term survival of the species. These surveys will include age class distribution, documentation of habitat losses and population increase or reduction for each population, quantification of impacts from trampling, grazing, disease, parasitism, etc. Surveys will utilize Global Positioning System and computer based Geographic Information System technology.

3.1 Inventory suitable habitat for *P. despainii*. This activity will be the responsibility of the BLM with assistance from the Service and Utah Natural Heritage Program (UNHP).

3.2 Inventory suitable habitat for *P. winkleri*. This activity will be the responsibility of the BLM and NPS with assistance from the Service and UNHP.

4. Establish and conduct monitoring, biological, ecological, life history and minimum viable population study for each species. Biological and ecological studies are needed for both species to determine the factors controlling the species distribution, abundance and their interaction within their ecosystem. Little is known concerning natural threats such as disease, parasitism, and grazing by native species on *P. despainii* and *P. winkleri*. Both species are vulnerable to parasitic beetles. No known diseases have been reported in this species. It is not known if the

populations of *P. despainii* and *P. winkleri* are at population levels that will assure long term demographic and genetic viability.

A minimum viable population is defined as a demographically stable population that is large enough to maintain genetic variation and to enable it to evolve and successfully respond to natural environmental variation (Menges 1986). Minimum viable population (MVP) studies are needed to determine at what level the species are demographically stable. These MVP studies will be designed to provide life history knowledge of the species and serve as ongoing monitoring studies for each species. If, as a consequence of these studies, other factors, natural or man caused, are identified as possibly having a detrimental effect on the species population which would preclude its eventual delisting those factors will be addressed and the recovery plan revised to accommodate them.

4.1 Establish and conduct monitoring, life history and minimum viable population study for *P. despainii*. This activity will be the responsibility of the BLM with assistance from the Service and UNHP.

4.2 Establish and conduct monitoring, life history and minimum viable population study for *P. winkleri*. This activity will be the responsibility of the BLM and NPS with assistance from the Service and UNHP.

4.3 Evaluate the phylogenetic relationships between *P. despainii* and *P. winkleri*. The phylogenetic relationship between these species is

poorly understood. Studies are needed to determine the genetic relationships between *P. despainii* and *P. winkleri* and the remainder of genus. Determination of their genetic similarity is necessary to understand the basic biology and to determine whether there is any taxonomic uniqueness at the generic level. This information will be useful in determination of recovery and management strategies for both species.

5. Establish and implement formal land management designations which would provide for habitat protection for *P. despainii* and *P. winkleri*. Formal land management designations need to be established and implemented to provide habitat protection for each of the species. Such designations may include the following: Research Natural Areas, Areas of Critical Environmental Concern, or designated Wilderness. Special protected areas similar to those mentioned above should ensure the long term protection of the populations of *P. despainii* and *P. winkleri* and their survival as vigorous reproducing species.

5.1 Land management designations for *P. despainii*. This activity will be the responsibility of the BLM with assistance from the Service.

5.2 Land management designations for *P. winkleri*. This activity will be the responsibility of the BLM and NPS with assistance from the Service.

individual living specimens of *P. despainii* and *P. winkleri* into the "National Collection of Endangered Plant Species" and, subsequently, propagation by its member institutions. These collections are for the purpose of maintaining a refuge garden population for those species which are threatened in their natural habitat and for conducting research beneficial to the species conservation and recovery, including techniques necessary for the establishment of additional populations in suitable habitat. This task will the responsibility of the Service with assistance from the various land managing agencies involved and the CPC.

7. Develop public awareness, appreciation and support for the conservation of *P. despainii* and *P. winkleri*. Education is a vital part of the recovery process. The cooperation of the public is essential in the ultimate success of the above recovery measures. This can be started with educational programs such as pamphlets and audio-visual programs for use in schools and groups interested in conservation. The introduction and maintenance of *P. despainii* and *P. winkleri* in recognized botanical gardens will assist in both public education of the significance and importance of this species and provide for a reserve of seeds and plants for reintroduction into the wild should wild populations be lost. The Service with assistance from Federal land managing agencies, public and private conservation groups, will be responsible for this activity.

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III IMPLEMENTATION SCHEDULE

The Implementation Schedule that follows outlines actions and costs for the recovery program. It is a guide for meeting the objectives elaborated under the Recovery section of this plan. This schedule indicates task priorities, task numbers, task description, duration of tasks ("ongoing" denotes a task that once begun should continue on an annual basis), the responsible agencies, and lastly, estimated costs. These actions, when accomplished, should bring about the recovery of *Pediocactus despainii* and *Pediocactus winkleri*, and protect their habitat.

Priorities in column one of the following implementation schedule are assigned as follows:

1. Priority 1 - An Action that must be taken to prevent extinction of, or to prevent the species from declining irreversibly in the foreseeable future.

2. Priority 2 - an action that must be taken to prevent a significant decline in species population/habitat quality or some other significant negative impact short of extinction.

3. Priority 3 - All other actions necessary to meet the recovery objective.

Key to Acronyms used in Implementation schedule

- UT - State of Utah, including the Utah Natural Heritage Inventory
- BLM - Bureau of Land Management
- CPC - Center for Plant Conservation
- NPS - National Park Service
- FWS - Fish and Wildlife Service
  - ES - Ecological Services
  - LE - Law Enforcement

Utah Pediocactus Recovery Implementation Schedule

Priority	Task	Task Description	Task Duration	Responsible Party			Cost			Comments
				FWS						
				Region	Program	Other	FY-01	FY-02	FY-03	
1	1.1	Enforce collecting prohibitions	ongoing	6	LE	BLM, NPS				Continuing federal program activity
1	1.2	Protect from international and interstate trade	ongoing	9	LE					Continuing federal program activity
1	1.3	Protect nonfederal populations	ongoing	6	ES	UT				Continuing federal program activity
1	1.4	Provide legitimate source of specimens	ongoing	6	ES	CPC				Continuing federal program activity
1	2.1	Control mineral development activities	ongoing	6	ES	BLM, NPS				Continuing federal program activity
1	2.2	Control recreational and grazing impacts	ongoing	6	ES	BLM, NPS				Continuing federal program activity
2	3.1	Inventory P. despainii habitat	3 years	6	ES	BLM, UT	5,000	5,000	5,000	
2	3.2	Inventory P. winkleri habitat	3 years	6	ES	BLM, NPS, UT	5,000	5,000	5,000	
2	4.1	Monitor P. despainii population	10 years	6	ES	BLM	5,000	2,000	2,000	
2	4.2	Monitor P. winkleri population	10 years	6	ES	BLM, NPS	5,000	2,000	2,000	
2	4.3	Determine relationship of P. winkleri and P. despainii	2 years	6	ES	BLM, NPS	8,000	8,000		
2	5.1	Land management designations for P. despainii	3 years	6	ES	NPS				To be incorporated in federal agency land use plans during periodic revisions.
2	5.2	Land management designations for P. winkleri	3 years	6	ES	BLM, NPS				To be incorporated in federal agency land use plans during periodic revisions.
3	6	Propagate P. despainii and P. winkleri plants	ongoing	6	ES	CPC	5,000	2,000	2,000	
3	7	Develop public awareness for P. despainii and P. winkleri	ongoing	6	ES	BLM, NPS, UT	5,000	1,000	1,000	